

93 Years of Geomagnetic Data Acquisition at the Huancayo Observatory

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Abstract The Department of Terrestrial Magnetism (DTM) of the Carnegie Institution of Washington (CIW) decided to establish a magnetic observatory in Peru in 1917. John A. Fleming, who belonged to the DTM, led the search for an adequate place for magnetic field observation. The Huancayo Magnetic Observatory was constructed from 1919 to 1921 and began its operation on 3 March 1922. The observatory has made important contributions to human knowledge such as the Forbush Decrease Effect and the Equatorial Electrojet. Thousands of scientists have used Huancayo's 93 years of geomagnetic data. In 1947, the DTM left the observatory to the Peruvian Government. A few years later, the Geophysical Institute of Peru (IGP) was established and becomes one of the most important scientific institutions in Peru. Details of past and present achievements of the IGP are presented.

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1. Introduction

The Department of Terrestrial Magnetism (DTM) of the Carnegie Institution of Washington (CIW) established the Huancayo Magnetic Observatory in 1922. It is located at geographic latitude 12.0° south and longitude 75.3° west at an elevation of 3,350 meters above sea level. In 1915, the DTM planned to correct the severe imbalance in the distribution of observatories by establishing two in the southern hemisphere. The southwest of Australia and the Peruvian Andes were selected for this purpose. The former was selected to fill a gap between two observatories located in Melbourne (southeastern Australia) and Mauritius (Indian Ocean) at the same latitude. The reason why the Peruvian Andes were chosen is that they are located near the magnetic equator (Johnston et al., 1948). The DTM decided to establish two geomagnetic observatories in Watheroo (Australia) and Huancayo (Peru). Johnston et al. (1948) gave details of the requirements to select these sites and described these locations and their buildings.

By the middle of 1935, seven Compton-Bannett type (C type) cosmic ray meters had been constructed by the DTM in the world (Lange and Forbush, 1936). One of these C Type meters (Forbush, 1937) was installed at the Huancayo Observatory in June 1936. The cosmic ray has been continuously observed at the Huancayo Observatory since 1936. In 1937, Scott E. Forbush discovered the Forbush Decrease Effect (Forbush, 1937). In the same year, the DTM installed one ionospheric sounder in the Huancayo Observatory. It led to discover the Equatorial Electrojet (Chapman, 1951).

On 1 July 1947, the DTM handed control of the Huancayo Magnetic Observatory to the Peruvian Government and until 1962, it operated under the title of the Geophysical Institute of Huancayo. Meanwhile, the Geophysical Institute of Peru (IGP) was established

and its headquarter created in Lima, the capital of Peru (Giesecke and Casaverde, 1998).

In July 1957, at the start of the International Geophysical Year, Mutsumi Ishitsuka, a young Japanese scientist from Kyoto University in Japan arrived at the Huancayo Observatory to establish a coronagraphic observatory in Peru. The Solar Physics Division of the Huancayo Observatory was reactivated as a result of his visit. Ishitsuka had searched for an adequate location in Peru for many years. Finally the construction of the coronagraphic observatory started in 1972, 70 km northwest of the Huancayo Observatory.

2. Geomagnetic Observations

Led by John A. Fleming, the search for a place to establish a magnetic observatory in Peru started in 1917. The Huancayo Magnetic Observatory began its operation in 1922. In July 1962, after 40 years of successful operations, the IGP was established (Giesecke and Casaverde, 1998). Many scientists around the world have used geomagnetic data provided by the Huancayo Observatory since 1922. Data is available from the International Real-time Magnetic Observatory Network (INETERMAGNET) and the World Data Center (WDC) for Geomagnetism, Kyoto University. The DTM of the CIW installed a magnetograph of Eschenhagen type at the Huancayo Observatory in 1922. It is still in operation and its data is used as backup. Hereafter, we refer to this magnetograph as Eschenhagen Magnetograph DTM (CIW) No. 2. Eschenhagen Magnetograph DTM (CIW) No. 1 was installed at the Watheroo Magnetic Observatory in Australia (Fleming et al., 1947).

Since the magnetic observatory was donated to the Peruvian Government in 1947, two key persons have made possible to create a solid Peruvian scientific institution. Alberto A. Giesecke became the first director of the IGP from 1947 to 1981 and Mateo Casaverde was accompanied by Giesecke as the sub

director. Nowadays after more than 90 years since the establishment of the DTM Geomagnetic Observatory, the IGP is one of the most recognized scientific institutions in Peru. This is due to the adequate management of Giesecke and Casaverde. In other words, Giesecke and Casaverde were pioneers in establishing geophysical sciences in Peru.

It is also important to be mentioned that uninterrupted data provided by the Huancayo Observatory is thanks to Federico del Castillo. He was the Director of the Huancayo Observatory from 1970 to 1984. In the early 1980s, terrorism began affecting the operations of the Huancayo Observatory. Collaborations between Japan and IGP have strengthened after Mr. Oscar Véliz from the Huancayo Observatory stayed in Japan for a year for training of magnetic observations in the 1970s. Some magnetometers from Tokyo University, Japan were installed in Huancayo. Actually the main instrument that provides five second (averaged one-second data) resolution data is the one from the Geophysics Research Laboratory (GRL), Tokyo University (Choque et al., 2014).



Figure 1. XYZ ring-core type Fluxgate sensor of the magnetometer installed at the Huancayo Observatory by the GRL, Tokyo University.

An economic, political, and social crisis occurred in Peru from the early 1970s until the end of the 1980s. As a result of this crisis, the IGP lacked funding for more than a decade. Terrorism caused social and political instabilities in the 1980s and this posed as a threat to the Huancayo Magnetic Observatory. The IGP established a geomagnetic observatory located at the same latitude as the Huancayo Magnetic Observatory in order to keep magnetic observations in Peru. By Mutsumi Ishitsuka's arrangement, the Japanese Government donated a set of magnetometers to establish the geomagnetic observatory at the Ancon Observatory of the IGP (geographic latitude: 11.79° south and longitude: 77.16° west) and vehicles to produce the geomagnetic map of Peru.

Because serious lack of funds affected the IGP in the 1980s, it was difficult to get photographic paper to record geomagnetic daily variations. Prof. Toshihiko Iyemori of the WDC for Geomagnetism, Kyoto University sent photographic paper to continue observations in the Huancayo Observatory. In the early 2000s when photographic paper was not available, Erick Vidal, who is an electronic technician of the Huancayo Observatory, constructed a digital system for the Eschenhagen Magnetograph DTM (CIW) No. 2 to record geomagnetic variations instead of photographic paper (see Figure 2).

3. Cosmos Coronagraphic Observatory

When Mutsumi Ishitsuka arrived at the Huancayo Observatory from Kyoto University in 1957, he was in charge of the Solar Physics Department and his main purpose was to establish a coronagraphic observatory. After searching for an appropriate Peruvian location for coronagraphic observation, he began the construction of the Cosmos Coronagraphic Observatory in 1972. The observatory is located near the Huancayo Observatory. The construction of the Cosmos Observatory took almost 20 years to complete. Unfortunately, it was destroyed by a terrorist organization called Sendero Luminoso (Shining Path) on 31 October 1988.



Figure 2. DTM Eschenhagen variometer and the digital system constructed by Erick Vidal at the Huancayo Observatory.

Table 1. Relevant events after settlement of the Huancayo Magnetic Observatory

Year	Event	Institution	Director
1922	Establishment of the Huancayo Magnetic Observatory	The Department of Terrestrial Magnetism (DTM) of the Carnegie Institution of Washington (CIW)	
1947	Transfer to Peruvian Government	Instituto Geofísico de Huancayo	
1957	International Geophysical Year		
1962	Establishment of the Geophysical Institute of Peru	Instituto Geofísico del Perú (IGP)	
1970s	Beginning of Crisis		Alberto Giesecke (Director) and Mateo Casaverde (Sub Director)
1992	Personnel Reduction		Federico del Castillo (Huancayo Observatory Director)
2003	The Huancayo Observatory is accepted as an observatory of the INTERMAGNET.	INTERMAGNET	



Figure 3. The Cosmos Coronagraphic Observatory.

Mutsumi Ishitsuka received financial support from the Japan International Cooperation Agency (JICA) for sending staff working in the Huancayo Observatory to Japan for on-the-job training from 1974 to 1987. Almost ten technicians and engineers were trained in different fields (solar observation, geomagnetic observations, seismology, fine mechanics, electronics, and so on) in different institutions (National Astronomical Observatory of Japan, Kakioka Magnetic Observatory, National Museum of Nature and Science, Tokyo University, Nagoya University, Kyoto University, and Shiga University) in Japan.

To solve the economic crisis of the 1980s, the Peruvian Government decided to reduce personnel of national institutions. The number of staff in the Huancayo Observatory decreased from 35 to 5 in 1992. Many instruments were abandoned due to the lack of manpower and funds. This caused the Huancayo Observatory to experience a deep crisis. Fortunately the geomagnetic observations could have continued with some deficiencies although the magnetic data had not been continuously recorded at the Huancayo Observatory. On the other hand, authorities of the IGP



Figure 4. Coronagraph at the Cosmos Observatory destroyed by the terrorists on 31 October 1988.

unfortunately did almost nothing to avoid loss of valuable people with particular skills such as those staff trained in Japan.

4. Summary

Establishment of a magnetic observatory in Huancayo in 1922 by the DTM of the CIW led the Peruvian Government to the foundation of the IGP. Now it is one of the most important scientific institutions in the country. Alberto Giesecke and Mateo Casaverde conducted the Huancayo Observatory and the IGP for the first 34 years. They are the two key persons who successfully conducted the Huancayo Observatory and the IGP to a recognized institution in the country by their adequate management. When the political, social and economic crisis affected the country, scientific institutions like the IGP suffered deeply. Terrorists destroyed the important solar observatory in Peru. The valuable engineers trained in Japan were lost. The IGP made best efforts to have continuous geomagnetic data with the help from the Japanese institutions and the Japanese Government in spite of difficult situation. The IGP magnetic observatory has provided 93 years of uninterrupted data for scientific community since 1922.

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